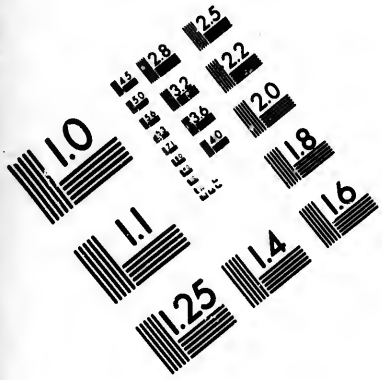

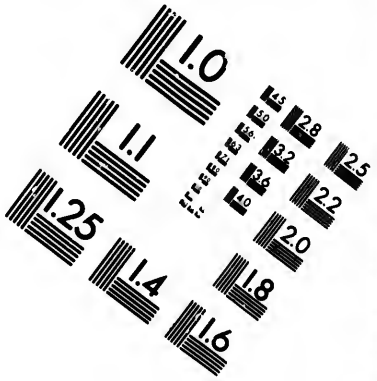

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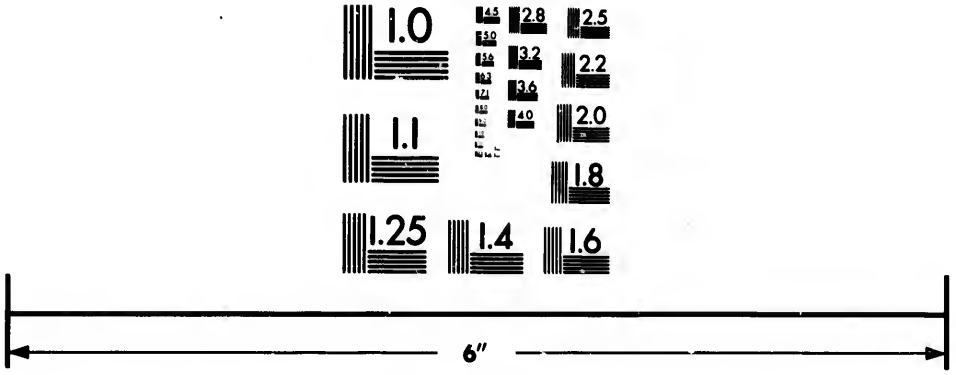

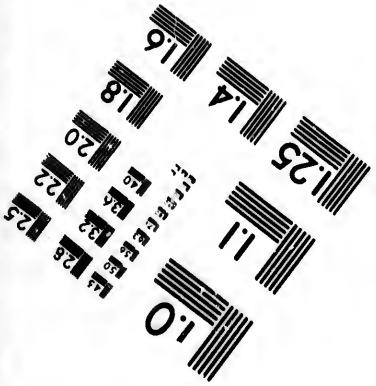

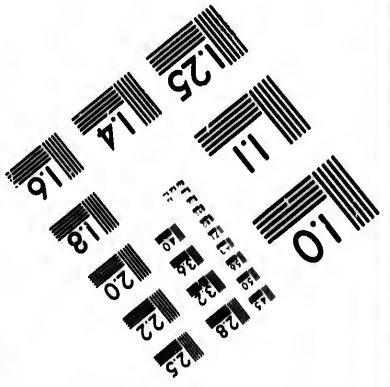

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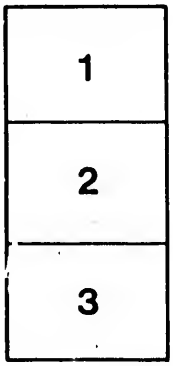

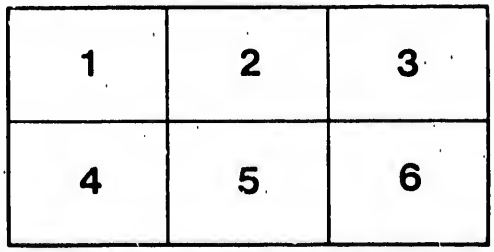

From "The Canadian Journal" of November, 1869.

ON THE CHANGES OF BAROMETRIC PRESSURE, AND PRESSURE OF VAPOUR THAT ACCOMPANY DIFFERENT WINDS, AT TORONTO,

FROM OBSERVATIONS IN THE SEVEN YEARS, 1860-66 INCLUSIVE.

BY G. T. KINGSTON, M.A.,

DIRECTOR OF THE MAGNETIC OBSERVATORY, TORONTO.

The object in the following paper is to shew the connection which subsists between the direction of the wind and the rapidity of the changes, whether of increase or diminution, which take place in the pressure of air and of vapour.

The changes considered in the investigation are limited to those in which the direction of the wind did not vary between two consecutive observations by more than $22\frac{1}{2}°$ on each side of one of the eight principal points; and as such comparative constancy in direction will usually occur only when the interval is short, it was found convenient to employ only the differences between 6 a.m. and 8 a.m., between 2 p.m. and 4 p.m., and between 10 p.m. and midnight.

The total change in the reading between two consecutive observations being first diminished by the change due to diurnal variation, the remainders were then classed according to the direction of the wind in the interval, and their averages in each class taken, for the year collectively as well as separately for the two half-years.

The average changes of barometric pressure which take place in two hours, and found in the manner just described, are given below for each of the principal eight point of the wind's direction.

APRIL TO SEPTEMBER.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
+·0085	—·0043	—·0112	—·0057	—·0084	—·0041	+·0132	+·0150

OCTOBER TO MARCH.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
+·0087	—·0160	—·0334	—·0313	—·0222	—·0027	+·0168	+·0209

THE YEAR.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
+·0086	—·0103	—·0215	—·0164	—·0129	—·0039	+·0156	+·0180

The most probable values of the changes corresponding to intermediate directions of the wind are given by the following formulæ, where Ψ_1 Ψ_2 Ψ_3 represent the changes for the two half years and year, and θ the angular distance of the point from which the wind blew, measured from the North towards the East, end expressed in degrees.

APRIL TO SEPTEMBER.

$$\Psi_1 = +\cdot0004 + \cdot0125 \sin(\theta + 141^\circ 29') + \cdot0044 \sin(2\theta + 186^\circ 29') + \cdot0025 \sin(3\theta + 14^\circ 2')$$

OCTOBER TO MARCH.

$$\Psi_2 = -\cdot0075 + \cdot0281 \sin(\theta + 148^\circ 14') + \cdot0024 \sin(2\theta + 160^\circ 49) + \cdot0014 \sin(3\theta + 30^\circ 15')$$

THE YEAR.

$$\Psi_3 = -\cdot0028 + \cdot0195 \sin(\theta + 148^\circ 2') + \cdot0040 \sin(2\theta + 174^\circ 17') + \cdot0021 \sin(3\theta + 10^\circ 47)$$

PRESSURE OF DRY AIR.

The average changes in the pressure of dry air in two hours with different winds, and the corresponding formulæ of interpolation, are as follows.

APRIL TO SEPTEMBER.

N.	N.E.	E.	S.E.	S.	S.W.	N.	N.W.
+·0146	—·0009	—·0128	—·0088	—·0122	—·0046	+·0195	+·0219

OCTOBER TO MARCH

N.	N.E.	E.	S.E.	S.	S.W.	N.	N.W.
+·0110	—·0182	—·0371	—·0342	—·0240	—·0026	+·0195	+·0240

THE YEAR.

N.	N.E.	E.	S.E.	S.	S.W.	N.	N.W.
+·0128	—·0091	—·0243	—·0194	—·0160	—·0034	+·0195	+·0229

APRIL TO SEPTEMBER.

$$\Psi_1 = +\cdot0021 + \cdot0162 \sin(\theta + 135^\circ 13') + \cdot0046 \sin(2\theta + 198^\circ 10') + \cdot0034 \sin(3\theta + 10^\circ 18')$$

OCTOBER TO MARCH.

$$\Psi_2 = -\cdot0077 + \cdot0317 \sin(\theta + 149^\circ 4') + \cdot0030 \sin(2\theta + 156^\circ 2') + \cdot0016 \sin(3\theta + 217^\circ 29')$$

THE YEAR.

$$\Psi_3 = -\cdot0021 + \cdot0237 \sin(\theta + 144^\circ 46') + \cdot0040 \sin(2\theta + 174^\circ 17') + \cdot0026 \sin(3\theta + 15^\circ 39')$$

PRESSURE OF VAPOUR.

The average changes in the pressure of vapour in two hours that accompany winds from the eight principal points, and the formulæ for finding the most probable change, with the wind blowing from any intermediate point, are given below :

APRIL TO SEPTEMBER.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
−·0057	−·0034	+·0020	+·0035	+·0042	+·0001	−·0073	−·0069

OCTOBER TO MARCH.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
−·0025	+·0009	+·0037	+·0031	+·0017	−·0013	−·0032	−·0039

THE YEAR.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
−·0041	−·0012	+·0025	+·0034	+·0034	−·0007	−·0046	−·0054

APRIL TO SEPTEMBER.

$$\Psi_1 = -\cdot00169 + \cdot00607 \sin(\theta + 305^\circ 49') + \cdot00096 \sin(2\theta + 88^\circ 48') + \cdot00110 \sin(3\theta + 181^\circ 2')$$

OCTOBER TO MARCH.

$$\Psi_2 = -\cdot00018 + \cdot00585 \sin(\theta + 330^\circ 26') + \cdot00034 \sin(2\theta + 287^\circ 6') + \cdot00022 \sin(3\theta + 243^\circ 26')$$

THE YEAR.

$$\Psi_3 = -\cdot00084 + \cdot00479 \sin(\theta + 312^\circ 43') + \cdot00056 \sin(2\theta + 86^\circ 44') + \cdot00037 \sin(3\theta + 216^\circ 15')$$

If in the nine foregoing formulæ, the variable angle (θ) be made equal in succession to 0, 11° 15′ (11° 15′)×2, (11° 15′)×3, &c. &c. ..... (11° 15′)×31, the changes of pressure will be found which would most probably occur if the wind were to blow steadily for two hours from each of the thirty-two points of the compass.

The results are given in the annexed Table.

Table shewing the changes in Barometric Pressure, Pressure of Dry Air and Pressure of Vapour, which take place in two hours, during winds from each of the Thirty-two points of the Compass.

	Barometric Pressure.			Pressure of Dry Air.			Pressure of Vapour.		
	April to Sept.	Oct. to March.	Year.	April to Sept.	Oct. to March.	Year.	April to Sept.	Oct. to March.	Year.
North	+·0083	+·0088	+·0083	+·0144	+·0110	+·0127	—·0057	—·0026	—·0042
N b E	+·0058	+·0035	+·0044	+·0117	+·0068	+·0083	—·0056	—·0019	—·0037
N N E	+·0029	—·0026	—·0001	+·0082	—·0027	+·0032	—·0052	—·0010	—·0030
N E b N	—·0005	—·0092	—·0050	+·0040	—·0105	—·0027	—·0045	·0000	—·0021
N E	—·0041	—·0158	—·0100	—·0007	—·0182	—·0088	—·0034	+·0010	—·0011
N E b E	—·0074	—·0220	—·0146	—·0054	—·0252	—·0146	—·0020	+·0019	·0000
E N E	—·0099	—·0272	—·0184	—·0093	—·0300	—·0195	—·0005	+·0027	+·0009
E b N	—·0112	—·0310	—·0208	—·0120	—·0349	—·0228	+·0009	+·0033	+·0017
East	—·0113	—·0334	—·0218	—·0131	—·0372	—·0244	+·0020	+·0036	+·0024
E b S	—·0103	—·0343	—·0214	—·0127	—·0379	—·0243	+·0028	+·0037	+·0028
E S E	—·0086	—·0340	—·0199	—·0114	—·0373	—·0230	+·0032	+·0037	+·0032
S E b E	—·0068	—·0329	—·0180	—·0098	—·0359	—·0211	+·0034	+·0035	+·0034
S E	—·0055	—·0312	—·0160	—·0086	—·0341	—·0192	+·0035	+·0032	+·0036
S E b S	—·0052	—·0293	—·0147	—·0084	—·0321	—·0178	+·0036	+·0029	+·0037
S S E	—·0058	—·0273	—·0132	—·0093	—·0298	—·0170	+·0039	+·0025	+·0037
S b E	—·0071	—·0250	—·0134	—·0109	—·0272	—·0166	+·0041	+·0021	+·0036
South	—·0085	—·0222	—·0131	—·0124	—·0239	—·0161	+·0042	+·0016	+·0033
S b W	—·0093	—·0187	—·0123	—·0131	—·0199	—·0149	+·0040	+·0010	+·0027
S S W	—·0090	—·0145	—·0106	—·0122	—·0149	—·0124	+·0032	+·0003	+·0018
S W b S	—·0071	—·0094	—·0077	—·0093	—·0090	—·0086	+·0019	—·0004	+·0007
S W	—·0038	—·0037	—·0036	—·0044	—·0027	—·0033	+·0001	—·0012	—·0006
S W b W	+·0005	+·0022	+·0014	+·0018	+·0038	+·0028	—·0021	—·0019	—·0019
W S W	+·0052	+·0079	+·0066	+·0084	+·0099	+·0091	—·0042	—·0025	—·0030
W b S	+·0096	+·0120	+·0115	+·0146	+·0152	+·0148	—·0060	—·0029	—·0040
West	+·0131	+·0168	+·0154	+·0195	+·0194	+·0194	—·0073	—·0033	—·0047
W b N	+·0153	+·0196	+·0131	+·0225	+·0223	+·0224	—·0070	—·0035	—·0052
W N W	+·0162	+·0211	+·0194	+·0237	+·0241	+·0239	—·0079	—·0037	—·0054
N W b W	+·0160	·0214	+·0194	+·0234	+·0247	+·0239	—·0075	—·0038	—·0054
N W	+·0151	+·0203	+·0184	+·0222	+·0242	+·0230	—·0069	—·0033	—·0053
N W b N	+·0137	+·0191	+·0167	+·0204	+·0227	+·0213	—·0063	—·0037	—·0051
N N W	+·0121	+·0166	+·0144	+·0186	+·0200	+·0190	—·0059	—·0035	—·0049
N b W	+·0103	+·0132	+·0118	+·0166	+·0161	+·0162	—·0057	—·0031	—·0046

By examining the table it will be seen that on the average of the year the barometer rises with a wind from any point between S W b W (measured from left to right) to N b E, and that it falls with winds

from NNE to SW. The same rule also holds (within a point) in summer and winter separately, and is true also with respect to the changes in the pressure of dry air. The pressure of vapour increases with a wind between E N E to SW b S and diminishes with a wind between SW and NE.

On the average of the year, and during the winter half-year, both the rise and fall have an uninterrupted progression; and the same is true in every case where the change is an increase; but in the summer half-year, besides the maximum rate of barometric fall which occurs with a wind from E, there is a second inferior maximum fall when the wind is from S b W. There are also two maxima in the rate with which the pressure of dry air diminishes during the summer. They are of equal magnitude — ·0131 and also occur with winds from E and S b W.

The most rapid changes, together with the winds that accompany them, are shewn in the following tables:

BAROMETRIC PRESSURE.

	SUMMER.		WINTER.		YEAR.	
	Change in 2 hours.	Wind.	Change in 2 hours.	Wind.	Change in 2 hours.	Wind.
Most rapid rise	+·0162	WNW	+.0214	NWbW	+·0194	NWbW½W
Most rapid fall	—·0113	E	—·0343	EbS	—·0218	E
	—·0093	SbW				

PRESSURE OF DRY AIR.

	SUMMER.		WINTER.		YEAR.	
	Change in 2 hours.	Wind.	Change in 2 hours.	Wind.	Change in 2 hours.	Wind.
Most rapid rise	+·0237	WNW	+·0247	NWbW	+·0239	NWbW½W
Most rapid fall	—·0131	E	—·0379	EbS	—·0244	E
	—·0131	SbW				

PRESSURE OF VAPOUR.

	SUMMER.		WINTER.		YEAR.	
	Change in 2 hours.	Wind.	Change in 2 hours.	Wind.	Change in 2 hours.	Wind.
Most rapid rise	+·0042	S	+·0037	EbS½S	+·0037	SSE½E
Most rapid fall	—·0079	WbN½N	—·0038	NW½W	—·0054	NWbW½W